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Fireproof Concrete Homes May Be Built at Moderate Cost

Concrete Floors Are Most Important Feature—Contractor Should Emphasize His Experience and Responsibility—Plans for Fireproof Homes

CONCRETE floors are the key to fireproof homes. Many homes, both large and small, have been built with exterior walls of fireproof materials. The owners have deluded themselves with the comfortable idea that they have had fireproof homes, only to find that a basement fire, which is the most dangerous because fire works upward, has made the fireproof shell an ideal furnace for burning the floors and interior partitions.

The larger homes were the first to adopt concrete floors, as a natural result of the safety and satisfaction of such floors in clubs, hotels, office buildings and other large structures.

Contractor Must Have Experience

With the progress made, both in design and construction methods for concrete floors, the owner of a small home may now enjoy their advantages at a cost but little more than for conventional floors of less permanent construction. The chief requirement for constructing concrete floors at a reasonable cost is a contractor in sympathy with this type of construction, and with adequate knowledge and experience to build them.

The floors of every residence must fulfill two purposes, structural and decorative. Too often residence floors are not of adequate strength and rigidity, and while they do not actually fail, are subject to considerable sagging and settlement, which is generally followed by plaster cracking on walls and ceilings and other troubles which are not only unsightly, but a drain on the owner's pocketbook. Furthermore, the structural floor should retard the upward advance of fires.

Structural Part of Floor

Naturally, the structural part of a concrete floor must provide a good base for subsequent decoration, because the floor finish provides the basis for the entire room decoration scheme. Variety in color and texture is just as attractive underfoot as overhead.

For this reason, reinforced concrete floors for residences are claiming more and more attention from progressive builders, architects and others who believe that the several advantages of this type of construction are just as desirable for residences as for clubs, hotels and larger buildings.

Types of Concrete Floor Construction

Reinforced concrete floor construction may be divided into two classes—monolithic concrete and the precast concrete systems, in which sections are cast at a central plant. Three common monolithic types are the solid slab, ribbed floor, and tile-and-joist floor.

The solid slab is generally from 4 to 6 in. thick for residence spans up to 15 ft. For longer spans this type will seldom be economical. Its advantage over the other two types lies in its simplicity of design and the fact that the form work can be made from ordinary lumber by methods understood by most contractors.

Another popular type of comparatively low cost is the ribbed floor. This type requires the least amount of steel and concrete for residence loading. It consists of parallel reinforced joists 24 to 36 in. on center, with a 2-in. or 3-in. concrete slab cast monolithically with the joists. The spaces between the joists are left hollow and are formed by inverted metal or wood trough-shaped pans, which are set on planks before the concrete is placed and removed after it has hardened.

The tile-and-joist floor is similar to the ribbed floor except that the spaces between the joists are filled with hollow tile of concrete or clay. This type usually costs more than the other two, but is preferred by some architects and engineers because of the additional heat and sound insulation provided by the hollow spaces in the tile.

Some Recent Precast Types

Recent progress in fireproof concrete floor design has developed some economical types costing little more than conventional wood joist floor construction.

In this classification, we find the floor constructed with steel beams or precast concrete joists with a 2-in. to 3-in. reinforced concrete slab on top. The beams and joists are made the length required by the plan. They are readily set in place on the walls, slab forms are supported by the joists, and the slab is concreted.

The use of precast concrete joists has proved quite popular in certain localities and promises to become widespread in the future.

Plaster ceilings are not required for first floors of reinforced concrete, because the floor itself provides adequate fire protection and the concrete ceiling can be painted to look very attractive. The slab floor produces a smooth ceiling, while the ribbed floor provides an attractive beamed ceiling. The tile-and-joist floor is generally plastered.

Floor Finish of Any Type

Many people do not realize that fireproof floors can be given any finish desired by the owner. More than that, the floor finish can be different in the different rooms to better fit the use and characteristics of each room.

The most common finishes are hardwood floors laid on sleepers imbedded in concrete or secured by metal devices, colored concrete topping marked off in pattern and waxed and polished, concrete or ceramic tile, linoleum, or cork tile, and all-over carpets. This ability of the concrete floor to be finished in any manner is one of its outstanding advantages.

Exterior Wall Construction

Considering the walls in a fireproof concrete home, these may be of either monolithic or concrete masonry construction, or possibly some form of unit construction. Concrete masonry is an economical, standard and thoroughly satisfactory type; and because it is immediately available in every city, it will be selected for discussion.

The masonry wall can be given practically any desired finish on both interior and exterior. An economical exterior is provided by exposed masonry walls, known as ashlar construction, with the units laid in either regular or random pattern. The masonry is finished with plain or colored portland cement paint to give the desired effect and appearance.

Concrete masonry also provides an ideal base for portland cement stucco. True portland cement stucco is a permanent finish of minimum cost. It offers a variety of textures and colors to harmonize with the architecture of the house. On the inside, concrete masonry walls may be finished in any of the usual methods—painted, plastered or textured.

Where climatic conditions permit, the plaster is applied directly to the masonry walls. In colder climates, requiring a higher wall insulation, the walls should be furred and plastered in the usual manner or otherwise insulated. Walls built two units thick with an air space between have been suggested as a type which could be plastered direct.

In fireproof homes designed for a flat roof, the reinforced concrete slab provides the same rigid fireproof construction as in floors. Pitched roofs are fireproofed on the outside with cement-asbestos shingles or concrete tile. The underside of the rafters is protected with metal lath and plaster or other fireproofing. Eaves are fireproofed and weatherproofed with portland cement stucco and metal lath. The chimney is of concrete with approved flue lining.

From this brief description of the fireproof concrete home, it is clear that there is no mystery or trick connected with its construction. Experienced contractors everywhere have been building concrete floors of one type or another for years. Concrete masonry wall construction is nothing new. There is nothing unconventional about the roof construction just described.

Owners Must Safeguard Their Investments

The average prospective home owner is not familiar with the details of house construction, nor does he fully appreciate the advantages of the fireproof, low-maintenance type of house which costs less money in the long run. He must depend upon the integrity and workmanship of the contractor and builder. When impermanent materials are used, depreciation starts early and increases at a rapid rate. The house the owner thought was a bargain turns out to be something that squeaks, cracks, sags, warps, blisters and looks down at the mouth, in spite of all the money he spends on it. Had he invested in a well built home, with permanent floors, walls, partitions and roof that do not crack or sag or do those other annoying things, his pocketbook, health and disposition would all be better off.

It is not difficult to secure plans for fireproof homes adapted to the ideas and desires of the prospective builder. For example, concrete and concrete masonry construction are more adaptable to the modern demands for tile floors and walls, and offer a wider variety of floor finishes than any other type of construction. Architects are familiar with fireproof construction and can furnish the plans. Where an architect's services are not retained, plans may be secured from the Architects' Small House Service Bureau. Building information and suggested designs are available from the Portland Cement Association.

From the standpoint of the architect and the contractor the best part of the story is that the fireproof home is actually here. It is not a dream or a picture on a drafting board. Thousands of families already enjoy its comforts and economies. To develop the interest now being expressed in fireproof homes, it only remains to make these facts known to prospective home builders in your community.

The Flint, Michigan, concrete residence of C. J. Ross. Grant Bowers, Flint, architect. Wall construction is portland cement stucco on cinder block

Reinforced Concrete Wins Approval as Shockproof Construction

Dr. Bailey Willis Definitely Favorable to Monolithic Concrete for Earthquake-Resistant Structures—Must Have Structural Unity and Rigidity Against Swaying

SINCE the occurrence of the earthquake that shook the area centering on Long Beach, Calif., on March 10, many engineers have examined and reported on the manner in which various types of construction were affected.

Among these investigators is Dr. Bailey Willis, of Stanford University, internationally known consulting geological engineer. After a survey of the buildings which withstood the earth tremors at Long Beach he declared that present-day principles of construction had been vindicated.

Prof. Willis, who has investigated the causes and effects of earthquakes all over the world, is responsible for many of the modern building practices on the Pacific Coast. In co-operation with structural engineers of San Francisco and other coast cities these principles were worked out at Stanford University with the aid of a shaking table. Miniature buildings were constructed on this table, which was subjected to shocks similar to the actions of the earth's surface in a quake.

Unity of Construction Is Imperative

"Two well established principles have been confirmed and we have gained a better understanding of the reasons for them," Prof. Willis says. "They are unity of construction and rigidity of structure.

"Unity of construction means that the structure shall be a coherent unit in which every part and all bonds between parts shall be equally competent to take the stresses to which they will be subjected individually.

"In modern practice unity is secured in those structures that are firmly tied together by outside walls and floors of reinforced concrete, whether the frame be of reinforced concrete or steel.

"The earthquake-resistant competency of a building depends upon the unity of its outside walls and floors as parts of a rigid coherent whole. Structures which do not possess coherent unity and strength are not earthquake-resistant and constitute a menace to life and property.

Structures Must Be Rigid

"The requirement of rigidity demands that the structure, when struck by a shock, shall deflect very slightly and return very quickly. A mere shiver is the ideal. This is an old idea but it has been brought within practical limits in the recent investigations.

"Any building has a definite swinging period which is fixed by its proportions and construction. The maximum stresses develop in a building when it swings in unison with the vibrations of the ground. Coincidence of periods produces resonance.

"If a building can be so rigid that it merely shivers, if its period is less than half a second, resonance is not likely to occur. For buildings of five or six stories, and probably up to ten or twelve stories in most cases, this degree of rigidity can be obtained by monolithic construction of reinforced concrete; or, where for any reason a steel frame is preferred, by imbedding the frame in concrete walls and floors, with suitable reinforcing steel and bonds throughout the structure.

Reinforced Concrete Walls Considered Necessary

"There is at present in current practice no other material than reinforced concrete, or possibly reinforced brick, that is strong enough or can be bonded properly to give the required rigidity.

"It is gratifying that insurance engineers have kept up with the latest advances in research in the matter of earthquake-resistant construction, and that rates for earthquake insurance are adjusted accordingly. By far the greater number of buildings that are insured are designed for rigidity, and to secure the lowest rates they must now have reinforced concrete walls throughout and reinforced concrete partitions where irregular distribution of masses destroys unity of the whole. The walls and partitions, not the frame, are the dependence for resistance."

Pipe Association Meeting to Be Held at Chicago

The annual meeting of the American Concrete Pipe Association will be held June 26 and 27, at Chicago, Ill.

Headquarters will be located at the Edgewater Beach Hotel.

PERSONALS

D. R. Collins, who has been closely identified with the concrete products industry for many years, and who for some months has represented the Concrete Masonry Association in bringing concrete masonry to the attention of the various construction divisions of the federal government at Washington, D. C., has been appointed assistant manager of the cement products bureau of the Portland Cement Associtaion, 33 W. Grand Ave., Chicago. In his new position Mr. Collins succeeds W. G. Kaiser, recently appointed manager of that bureau.

Albert P. Greensfelder, president of the Fruin-Colnon Contracting Co., has been nominated as a candidate for election to the board of directors of the U. S. Chamber of Commerce to represent the civic development department.

The Threatening Shadow of Diversion

By E. M. FLEMING
Manager, Highways and Municipal Bureau, Portland Cement Association, Chicago

Gasoline Tax Funds Diverted or Jeopardized in Twenty-Eight States—Irreparable Setback to Nation's Highway Program Unless Raids Are Stopped—Co-Ordination of Forces Needed

DIVERSION of motorist-contributed road revenue to other uses, which was begun in a small way a few years ago as a temporary expedient has reached proportions so staggering that—

(1) Our national investment in highways is jeopardized, both as to construction and maintenance funds.

(2) Serious impairment of credit is inevitable if motor tax funds are not applied to the road programs where they have been pledged.

(3) Highway programs will shrink to a whisper of reasonable plans and demonstrated needs.

(4) A new threat to employment is being thrust upon the country, inasmuch as 90 per cent of the money spent for road building goes into the pockets of workmen.

(5) The construction industry, with its myriad ramifications; the automobile industry, with its tremendous influence on national prosperity—pillars of strength in America's economic structure—will experience an unparalleled and unprecedented setback.

(6) The greatest wealth and work-producing agencies of modern times—standing like oases in a desert of doles and government subsidies—will be dried up at the source.

This miscarriage of implied intention and justice must be stopped and stopped quickly, if irreparable damage is to be avoided.

The most conservative estimates place the direct diversion of motor taxes by states in 1932 at more than $145,000,000. Indirectly—that is to say, where motor tax funds pledged for local road and street work were used as doles, as was the case in Ohio, Massachusetts and other states—it was a sum infinitely greater and difficult to tabulate.

Macing the Motorist

What about 1933? As the accompanying map shows, in 28 of the 48 states there are legislative proposals to divert (or keep on diverting) highway funds to other uses. Raids on the highway funds in some states have become so ruthless that the whole principle of road user taxation is being tossed into the discard. In New York it is proposed to divert almost 80 per cent of highway revenue. In South Dakota the current legislature has already passed a law giving one-half of the gas tax to counties for rural credits, while Rhode Island has legalized a $3,000,000 bond issue to be amortized in five years from gas tax funds. So what Professor Doriot, acting dean of the Harvard School of Business, calls "macing the motorist" goes brutally on.

Even Lawmakers Will Listen

"But what can anybody do about it?" asks the *New York Sun* editorially. "The gasoline tax has been a godsend to legislators more concerned with raising revenue than omitting expenses. It proved easily collectible and collections came up to expectations. It was a comparatively simple thing to add another cent for this emergency and another for that one. So the motorist pays and pays; if he listens to the voice of experience, he will make up his mind that he must keep on paying."

The assumption that nothing can be done about it is as mistaken as it is inexcusable. Experience has shown that justice will prevail if enough people are willing to fight for it. Lawmakers will listen to common sense, even in times of uncommon hysteria, if the protest has sufficient volume.

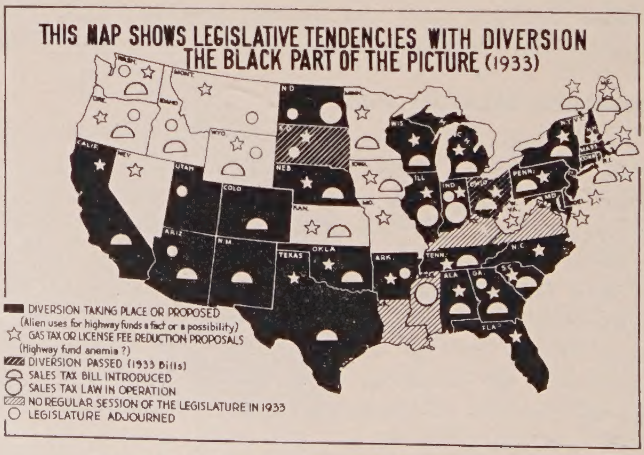
"The sinister aspects of diversion are fast becoming apparent," said J. Borton Weeks, president of the American Motorists' Association, in a recent statement, "and there are country-wide indications of a motorist revolt against continued use of motor funds for any purpose except highway extension, improvement and maintenance. This result cannot come too soon if the highway program is to be saved. . . . Effects of diversion are already apparent in badly maintained roads in some states. Such highways become a liability instead of an asset. The economic loss through damage to motor vehicles and injury to their occupants is enormous. Diversion not only seriously interferes with the upkeep of present highways, but postpones far into the future the ultimate completion of the country's road system."

Roads Are Worth All They Cost

The Lansing (Mich.) State Journal says: "The highway system of Michigan is worth all it cost. It has paid for itself. Come what may, the gasoline tax must not be turned to any other use than highway use. . . . The gasoline tax is the fairest kind of a tax when applied to highways, but it is the unfairest tax imaginable if applied to any general purpose."

As *The Baltimore Sun* puts it: "The time is ripe to sound a warning against the extent to which taxation of highway users is being miscarried."

There is the germ of a nation-wide movement in the


THIS MAP SHOWS LEGISLATIVE TENDENCIES WITH DIVERSION THE BLACK PART OF THE PICTURE (1933)
WASH.
ORE.
IDAHO
MONT.
WYO.
N D
S.D.
MINN.
CALIF.
NEV.
UTAH
COLO
NEB.
IOWA
KAN.
MO.
ARIZ.
N.M.
TEXAS
OKLA
ARK.
WIS
MICH.
ILL
IND.
OHIO
PENN.
N.Y.
VT.
N.H.
ME.
MASS
CONN.
R.I.
DEL.
MD
W. VA.
VA.
TENN.
N.C.
S.C.
GA.
ALA
FLA.
DIVERSION TAKING PLACE OR PROPOSED (Alien uses for highway funds a fact or a possibility)
☆ GAS TAX OR LICENSE FEE REDUCTION PROPOSALS (Highway fund anemia ?)
▨ DIVERSION PASSED (1933 Bills)
SALES TAX BILL INTRODUCED
SALES TAX LAW IN OPERATION
▨ NO REGULAR SESSION OF THE LEGISLATURE IN 1933
○ LEGISLATURE ADJOURNED

The threat to highway construction funds

New York Construction Council's plan to put every New York legislator on record regarding his attitude toward the use of gasoline tax and motor license funds.

As soon as anyone stops to consider the natural results that follow a diversion of the tax paid on gasoline, that person is immediately converted into a strong opponent of such a plan.

Co-Ordination of Forces Needed

What is needed is a co-ordination of the forces working to protect the road dollar. Motorists, engineers, contractors, highway officials—many factors interested in America's welfare, as well as the welfare of the construction industry—are pursuing a militant campaign in some states to KEEP MOTOR TAXES FOR ROADS ONLY. In other states, each group is waiting for some other group to rout the forces of diversion, dispersion and ultimate stagnation before such obstructionists have dug in to stay. But nothing short of prompt, united action will save the day.

Every man interested in highways, whether directly or indirectly, should affiliate himself with one or more of the organizations which are seeking to remind legislators that the only just basis for motor taxes is support of the highway system.

National Concrete Burial Vault Association Program

The effect of vibration on burial vault concrete will be one of the leading subjects of the annual meeting of the National Concrete Burial Vault Association to be held at Cleveland, Ohio, May 18 and 19.

W. G. Kaiser, manager of the cement products bureau of the Portland Cement Association, will have charge of a vibration demonstration.

The following program has been planned:

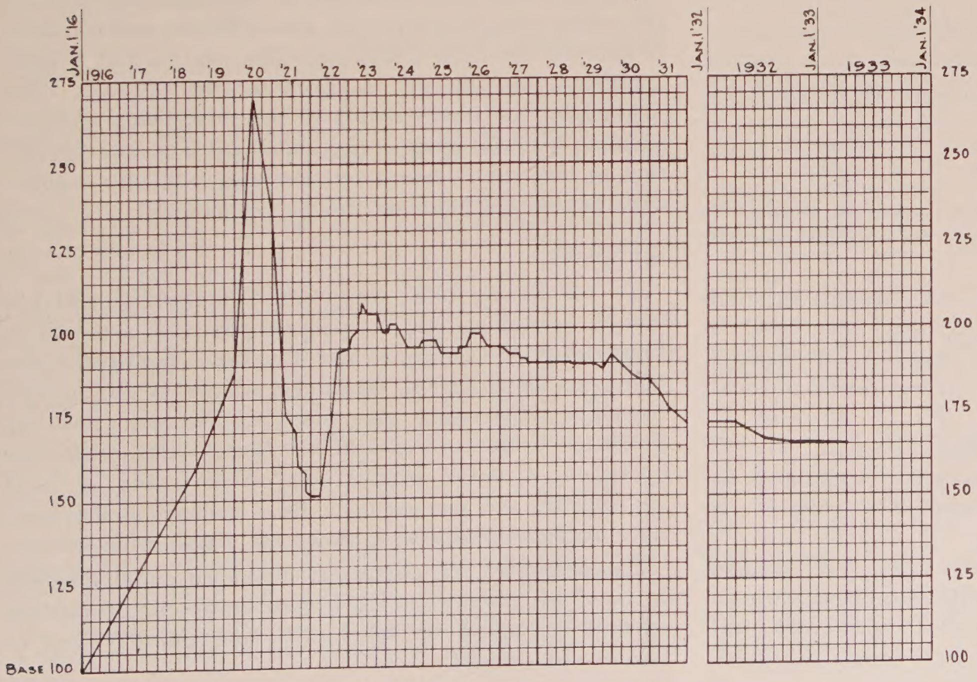
May 17—8:00 P. M. Board of directors meeting.
May 18—9:30. Registration.
10:00. Invocation by Rev. M. M. Brown.
Address of welcome by Mayor of Cleveland.
Response, President Ross P. Hilles.
Report of Secretary-Treasurer J. H. Stuart.
Election of three directors for three years each.
Appointment of committees.
11:15. Sales talk, Christy L. Berg, St. Louis, Mo.
1:00. Case School of Applied Science.
1:30. Testing sample cylinders; representative of Portland Cement Association in charge.
2:30. Vibration demonstration, in charge of J. I. McCarty, of Electric Tamper and Equipment Co.
3:30. Address by President Wickenden of Case School of Applied Science.
3:45. Address by Professor Danforth.
6:30. Banquet. After-dinner speaker, Warren Wade.
Reorganization of the board of directors.
May 19—10:00. Round-table discussion. Ten minutes allowed each speaker, to be led by
Fred J. Mead, Orange, N. J.
L. A. Chick, Blairsville, Pa.
C. E. Willbee, Jackson, Mich.
A. M. Lendrum, Norwalk, Ohio.
H. A. Dahlquist, Chicago, Ill.
E. C. Jefferies, Cleveland, Ohio.
11:15. Advertising, by F. H. Van Ness, Brooklyn, N. Y.
1:00. Summary of tests made at Case School, Mr. Kaiser of the Portland Cement Association.
Summary of vibration demonstration.
Round table discussion.

Minnesota Products Meeting

Concrete products manufacturers of Minneapolis, St. Paul and the surrounding territory held a meeting at the former city on April 5.

E. W. Dienhart of the cement products bureau of the Portland Cement Association at Chicago, was the chief speaker.

Abertthaw Index of Cost of Building



THE Aberthaw Index of cost of building construction for April 1 shows a drop of one point to 165, compared with 166 for January 1. The slight decline is due to minor variations in prices of building materials.

The index value of 165 is equivalent to $1.73 per sq. ft. of floor area for the 7-story reinforced concrete industrial building from which the value is compiled.

A distinct flattening out is seen in the trend of the cost curve, indicating the probability that the decline which started at the beginning of 1930 has reached its lowest point. Changes in the near future are likely to be upward rather than downward.

Propose Home Modernizing Campaign on Nation-Wide Scale

Where Concrete Improves Old Homes—Sources of Information for Local Organizers—Tie-Up with National Movement and Local Newspapers

HOME modernizing campaigns are under way at this moment in a number of large cities, including Philadelphia, Washington, Indianapolis, and Kansas City, and in many smaller cities.

It is a matter of enlightened self-interest on the part of architects and concrete contractors to give their time and effort to the development of such movements in cities which have not yet undertaken them, for concrete masonry, monolithic concrete, portland cement stucco, and various forms of ornamental concrete products, are certain to play a large part in home modernization.

Where Concrete Improves Old Homes

Old homes with foundation walls crumbling and sagging may be jacked up and provided with new foundations of concrete masonry or monolithic concrete.

Replacing the old basement floor with a modern concrete floor, or resurfacing the old floor with concrete, and adding a cement plaster ceiling on metal lath, will complete the transformation of the basement so far as construction work is concerned.

Shabby exterior walls may be modernized by coating them with portland cement stucco having life and color.

A decaying porch may be replaced with a modern sun room having a colored concrete floor, marked off to simulate tile or flagging.

A roof rebuilt and covered with cement-asbestos shingles or colored concrete tile will be attractive as well as fire-resistive and weather-tight.

Ornamental walks and drives of colored concrete or concrete flagging, garden walls, lily pools, rock gardens, terraces, and the like, will add value to the property far in excess of their cost.

Organizing a Local Campaign

All the information necessary as a guide in organizing a local modernizing campaign may be obtained for the asking.

First of all, there is the "Operating Manual for Conducting a Local Modernizing Campaign," mentioned on page 22 of the December (1932) issue of CONCRETE as being obtainable from the U. S. Department of Commerce, Washington, D. C.

Another pamphlet, entitled "Modernizing the Home," prepared for the President's Emergency Committee for Employment, contains several hundred suggestions on needed repairs and improvements.

Other material having exceptional value is the detailed description of the Philadelphia campaign, on which many others have been based, copies of which may be obtained by addressing Renovize-Philadelphia Campaign, N. E. corner Seventeenth and Sansom Sts., Philadelphia, Penna.

It has been observed that modernizing campaigns in individual cities, while highly successful as a means of creating local employment and accomplishing useful work, have been less satisfactory as stimulants to sales of building materials. This is believed to be due to the fact that the building materials and related products bought as a result of the campaign came from sources scattered over a large geographical section, rather than from local sources alone.

From this it is evident that a concerted movement in cities throughout the entire nation will be far more effective than the isolated efforts of individual cities could hope to be.

Fortunately, a movement of national scope is already under way—one with which local campaigns can become identified in a manner that will stimulate public interest.

Stimulate Interest with Cash Prizes

The larger movement to which reference has just been made is the National Better Homes Contest inaugurated by the monthly magazine *Better Homes and Gardens*, published at Des Moines, Iowa., by the Meredith Publishing Co. Cash prizes to the amount of $3,000 are offered for modernizing work actually accomplished.

Approximately 140 newspapers have become affiliated with this campaign, offering prizes in local contests sponsored by the newspapers themselves.

It is here that local modernizing campaigns can capitalize on the groundwork laid by *Better Homes and Gardens*. If none of the local newspapers has inaugurated a local contest, a fund should be raised for the purpose. The newspapers are in a position to sell advertising space to building material dealers and manufacturers, thereby getting at least some return on the large amount of space donated for free publicity for the campaign.

Summary

To summarize, local construction interests should obtain the pamphlets and campaign outlines from the U. S. Department of Commerce and the Renovize-Philadelphia Campaign organization, mentioned earlier in this article. Valuable information may also be obtained from the Portland Cement Association. Next, obtain the co-operation of *Better Homes and Gardens*, and of local newspapers, and inaugurate a local contest, at the same time urging contestants to enter the nation-wide contest.

Campaigns of this character, conducted simultaneously in hundreds of cities, will, beyond question, provide an effective stimulant to the construction industry and to business in general.

Road Builders Offer Specifications for Cement-Bound Macadam

Gustafson Committee Report Establishes Detailed Construction Practice for Penetration Type—Sandwich Type Suited to Resurfacing Old Gravel or Macadam

THE American Road Builders' Association Committee on Use of Concrete for Low-Cost Road Construction, headed by E. N. Gustafson, state highway resident and county engineer, Bay City, Texas, presented a detailed illustrated report at the annual sessions of the association, held in Detroit in January.

The section of the report that deals with cement-bound macadam is of particular value because of the revived interest in this type of highway construction. Both the penetration type and the sandwich type are described in the committee's report, but specifications are given for the penetration type alone. These specifications are here given in full.

(Beginning of Specifications)

1. DESCRIPTION. Cement-bound macadam pavement is rolled coarse stone held together by portland cement mortar. It is to be constructed by placing mortar having the consistency of thick cream over a layer of rolled stone of the specified thickness in such a way that the mortar penetrates the voids in the stone and completely fills them. The grouted stone is then consolidated by rolling and an even surface texture secured with a burlap belt.

Materials

2. PORTLAND CEMENT shall be of American manufacture and conform to the American Society for Testing Materials Standard Specifications for Portland Cement (Serial Designation C9-30) and be tested by the Standard Methods for Testing Cement (Serial Designation C77-32). Cement shall be protected from damage by moisture and when so damaged shall not be used.

3. FINE AGGREGATE shall be a clean, durable, strong natural sand, at least 95 per cent of which will pass a standard No. 4 sieve, not less than 5 nor more than 30 per cent shall pass the standard No. 50 sieve, and not more than 5 per cent shall pass the standard No. 100 sieve.

Fine aggregate showing more than 6 per cent, by volume, of clay, loam or silt in 1 hour's settlement, after shaking in an excess of water, shall not be used.

Fine aggregate which fails to pass the Standard Colorimetric Test of the American Society for Testing Materials (Serial Designation C40-27) shall not be used unless it can be shown that the failure to pass is caused by harmless materials.

4. COARSE AGGREGATE shall be crushed stone or a crushed gravel containing not more than 20 per cent of uncrushed particles. Not more than 5 per cent shall pass a standard 1½-in. sieve and not more than 10 per cent be retained on a standard 2½-in. sieve.

Coarse aggregate shall not show more than 4 per cent loss in the Standard Test for Abrasion of Rock (Serial Designation D2-26) of the American Society for Testing Materials and shall have a toughness of not less than 6 per cent when tested in accordance with the Standard American Society for Testing Materials Method of Test for Toughness of Rock (Serial Designation D3-18). Stone showing a loss in the Standard Test for Abrasion of Rock of more than 4 per cent but not more than 6 per cent may be used provided not more than 5 per cent passes a 2½-in. sieve and at least 95 per cent passes a 3½-in. sieve.

5. WATER shall be clean and free from oil, acid, alkali or vegetable matter.

6. JOINT FILLER.* Pre-molded joint filler shall be of such character that it will not be deformed by ordinary handling in hot weather nor become brittle in cold weather, and shall be sufficiently plastic to be extended from the joint as the joint closes.

The material for poured joints shall be a bitumen which will not run from the joints in hot weather nor become brittle in cold weather.

Construction

7. SUBGRADE. The subgrade shall have the grades shown on the plans. In preparing the subgrade a trench shall be formed to retain the stone. The bottom of the trench shall have a width equal to the specified width of the pavement and its sides shall be as nearly vertical as practicable.

The surface of the subgrade shall not have inequalities exceeding ½ in. when measured from a 10-ft. straight-edge.

The subgrade shall be compacted with a roller weighing not less than 7 tons.

Shoulders of the width shown on the plans shall be in place before stone is placed on the subgrade.

8. FORMS. If the contractor prefers, wood forms may be used for the sides of the trench. These shall have a height equal to the depth of the pavement and be strong enough to withstand the weight and pressure of rolling without being broken. Forms shall be firmly staked in place and shall not be removed until after the pavement has hardened.

9. JOINTS. A longitudinal dummy joint shall be provided for by setting a 1 by 2-in. wooden strip on the subgrade, along the center line. The strip shall be set in a straight or evenly curved line with its 2-in. edge vertical, and be firmly fastened in place so that it will not be disturbed by subsequent construction operations.

Transverse dummy joints* shall be constructed by placing 1 by 2-in. wooden strips from edge to edge of the subgrade at right angles to the center line, at intervals of ______ ft. They shall be fastened firmly in position with the 2-in. edge vertical.

Expansion joints* ______ in. wide shall be put in at ______ ft. intervals. Expansion joints shall extend from top to bottom and edge to edge of slab and be free from obstructions of any kind.

Premolded expansion joints shall be installed after the stone has been rolled by trenching the stone, setting the expansion material on, and at right angles to the subgrade, replacing and compacting the stone about it.

Poured joints shall be installed by trenching the rolled stone and setting a bulkhead in place on the subgrade, at right angles to the subgrade, replacing and compacting the stone about it. After the slab has partly hardened the bulkhead shall be removed. Before the pavement is opened to traffic the expansion joint space shall be filled with poured joint filler.

10. PLACING AND ROLLING CRUSHED STONE COURSE. After the subgrade has been properly prepared the stone course shall be spread between the forms by an approved method to a depth which, after rolling, will provide a thickness for penetration equal to that required for the finished pavement. The stone shall be so handled that there will be no segregation of sizes nor any other variation in distribution, and a uniform, even surface having a slope from center to sides of ¼ in. per ft. is secured. If any stone becomes dirty or mixed with the subgrade or shoulder material it shall be removed and replaced with clean stone before grout is placed. Unless approved by the engineer due to special conditions, only sufficient stone for one day's grouting shall be in place at one time.

The loose, ungrouted stone shall be rolled with a roller weighing not less than 7 tons. Rolling shall be concentrated in the area immediately ahead of the grout and shall be continued no longer than is necessary for proper compaction and smoothness of surface.

11. MORTAR OR GROUT. The mortar used in filling the voids in the stone shall be proportioned 1 bag (94 lb.) of cement to 2 cu. ft. of sand, measured dry and rodded, and sufficient water to produce a grout having the consistency of thick cream.

12. MIXING GROUT. Cement grout may be mixed at a central plant, truck-mixed or mixed on the job, providing the equipment meets with the engineer's approval. Suitable agitator bodies will be required for central mixing plant grout.

13. JOB-MIXED GROUT. Where grout is prepared on the job, a mixer with caterpillar traction shall be used and proper

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*Omit if expansion joints are not used.

provision made so that grout materials will not spill from the charging device to the surface of the stone and thus clog voids in the stone.

14. MIXING TIME. The mixing period for grout will depend upon the type and size of mixing equipment used. At least one minute of mixing will be required for job mixing. Where a central mixing plant is used at least one minute of mixing will be required and the grout shall be transported in agitator bodies which will agitate the grout sufficiently to prevent segregation enroute.

Where a central proportioning plant and transit-mixer bodies are used, the drums of the body shall be rotated while in transit to the job and during discharge operations, in order that there may be proper mixing and no segregation of grout ingredients. If, during discharge, the grout does not appear to be properly mixed, the drum shall be closed and rotated at the proper speed until thorough mixing is secured.

15. CONSISTENCY. The consistency of the grout shall be such that no separation of ingredients will occur and that voids in the rolled stone will be completely filled. An excessive amount of free water coming to the surface will be evidence that too much mixing water is being used.

16. MIXING WATER. A positive approved method shall be provided for measuring and loading mixing water. The water content required (including moisture in the sand) will vary with temperature conditions, size and kind of stone, and subgrade on which the road is constructed, but will amount to approximately (depending upon these conditions) 6¾ to 8½ gallons per sack of cement. Proper water content will be determined by the engineer.

17. DISTRIBUTING GROUT. Regardless of mixing method, the grout shall be distributed to the pavement surface without segregation by providing for separated streams of grout having a vertical drop of not more than 12 in. Grouting operations should be continuous between joints or during each day's operation. The use of two or more light push brooms for assisting grout distribution will be required.

18. INITIAL GROUT ROLLING. As soon as a sufficient amount of grout has been deposited (50 to 100 sq. yd.) the grouted stone will be immediately rolled with a tandem roller weighing not less than 5 or more than 7 tons in order to facilitate complete penetration of the grout. (One rolling should be sufficient at this time.)

19. STRAIGHT-EDGING SURFACE. The grouted surface shall be straight-edged immediately after the initial rolling and all irregularities greater than ½ in. on a 16-ft. straight-edge shall be adjusted by proper use of stone forks while the grouted stone is still pliable (due to wet grout). If depressions should occur which cannot be adjusted in this manner, then ½-in. stone shall be added and thoroughly consolidated to give an even surface. If the straight-edging and leveling work is done at the proper time, very little small stone will be required to adjust the surface.

20. FINAL GROUT ROLLING. At the proper time, determined by temperature and working conditions, the final rolling (with a 5 to 7-ton tandem roller) shall begin. Rolling shall continue, and if necessary additional grout added, until an even, dense surface is obtained, but with a minimum accumulation of grout above the surface of the stone. The desired amount of surplus grout is to be determined by trial and must be sufficient to provide for further settling into voids, to insure against projection of stone above surface, and to allow an even surface finish.

21. FINISHING SURFACE. At the proper time after final rolling, as determined by working conditions, the slight excess of mortar shall be evenly distributed over the pavement surface by means of long or short-handled floats or light push brooms. This shall be followed by the use of a 4-ply burlap belt moved forward with crosswise sawing motion in order to smooth up the surface. This process shall then be followed by pulling a single strip of burlap, approximately 3 ft. in width, with a direct forward motion over the pavement as a final surfacing operation.

(NOTE:—Burlap clings to the surface, smooths same, removing any surplus water and other accumulation. A final broomed surface would tend to gouge mortar from the tightly packed stone, resulting in a rough surface with projecting stones.)

22. CURING. As soon after final finishing as it can be done without marring the surface, the pavement shall be covered with wet burlap which shall be kept continuously wet and left in place 48 hours. Or, the burlap may be removed in 24 hours and be replaced by not less than 2 or more than 2½ lb. of dry calcium chloride. The calcium chloride shall be carefully and evenly spread.

When calcium chloride is added to the mortar as an admixture to obtain early hardening, curing other than 24 hours of wet burlap may be omitted if the engineer is satisfied that the early strength secured by the admixture offsets the additional strength secured through the curing methods stated above. The calcium chloride shall be introduced into the mixer drum in solution, and either with or following the mixing water. Two pounds of calcium chloride shall be used for each sack of cement.

23. OPENING TO TRAFFIC. Traffic shall be excluded from the pavement for at least one week, and for a longer period if the engineer directs.

(End of Specifications)

In the body of the report the committee discloses the interesting fact that cement-bound macadam of the penetration type was first employed in Edinburgh, Scotland, in 1872 and 1873. Pavements built at that time are still in service, and maintenance charges have been exceedingly low.

The first cement-bound macadam pavement in the United States was placed in Lynn, Massachusetts, in 1905. It later became known as the Hassam type in this country, and its use was continued until about 1920, when it became entirely supplanted by standard concrete. In the meantime about 100 miles of cement-bound macadam had been placed in Connecticut, 200 miles in Massachusetts, 100 miles in New York state highways and 150 miles in cities of that state, 150 miles of highway in Oregon, 50 miles of streets in Portland, Oregon, and 20 miles in Spokane, Washington, and smaller yardages in many other American cities.

Sandwich Type for Resurfacing

The sandwich type of cement-bound macadam differs from the penetration type in that it is usually built in thinner sections, is used for resurfacing old gravel or macadam roads, and mortar is placed between layers of stone and pressed into the voids by compaction. This latter construction procedure is responsible for the expression "sandwich type," the term having reference to the fact that the mortar is deposited between the two layers of stone.

Reinforcing Institute Meeting

A confidential session attended only by executives of member companies was to comprise the one-day meeting on April 25 of the Concrete Reinforcing Steel Institute, at the William Penn Hotel, Pittsburgh, Pa.

Coming Conventions

May 18-19—National Concrete Burial Vault Association. Statler Hotel, Cleveland, Ohio.

June 19-22—National Terrazzo and Mosaic Association, Inc. Palmer House, Chicago, Ill.

June 21-24—American Society of Agricultural Engineers, 27th annual meeting. Purdue University, Lafayette, Indiana.

June 26-27—American Concrete Pipe Association, twenty-sixth annual meeting. Edgewater Beach Hotel, Chicago.

June 26-30—American Society for Testing Materials, annual meeting. Stevens Hotel, Chicago, Ill.

June 26-July 1—American Society of Civil Engineers, annual convention. Chicago, Ill.

◆ EDITORIAL ◆

Sewerage Plants and Jobs

NEARLY six thousand cities and towns within the United States having populations of more than 1,000 are in urgent need of sewage disposal plants.

Most of these communities, especially those of relatively small population, have no disposal facilities at all, while in others the facilities provided are wholly inadequate. In the meantime the pollution of streams and lakes continues, destroying fresh-water life and creating a standing menace to public health.

The construction of sewage treatment plants will serve the double purpose of ending stream pollution and creating employment. Beyond a doubt, public works of this character constitute needed public improvements; and furthermore, these projects can be made self-liquidating. Nominal service charges similar to the plan employed in Atlantic City for more than twenty years provide the self-liquidating feature of these projects.

The Reconstruction Finance Corporation stands ready to grant loans to cities for the construction of treatment plants. Legislatures of at least twelve states have passed enabling acts permitting towns and cities to receive R. F. C. loans for this purpose, and other state legislatures are expected to take similar action before adjournment.

In consequence, all that is needed to start hundreds, and even thousands, of communities toward the construction of sewage disposal plants is local enterprise and initiative. The National Committee for Trade Recovery, the Portland Cement Association and other organizations are doing all they can toward assisting local public officials in preparing applications for loans and in getting through the various other formalities. But these organizations can not do it all. Local officials must take action, though in many cases such action will not be taken unless the officials are prodded by local construction industries and by public-spirited organizations such as the Izaak Walton League.

Proper co-ordination of effort, both local and national, will drive home the idea that a community which contributes to the pollution of streams is a disgrace to the nation, and that a community which makes no effort toward correcting the situation is dodging a patriotic duty.

Realization of these simple facts on the part of the general public will create sentiment in favor of definite action. The concrete construction industry has much to gain from the development of this sentiment; and at the same time the primary purpose of creating useful work will have been fulfilled.

Jackson County Leads

A REMARKABLY well illustrated book entitled "Results of County Planning—Jackson County, Missouri," has been issued under the authority of the county court at Independence, Missouri, of which the presiding judge is Harry S. Truman.

This unusual book has been published as a means of showing in pictorial form the natural scenic beauty of the rural sections that have been made accessible to the nearby city population through construction of a planned system of county roads.

The county plan, now completed, provides a market for the products of thousands of farms, and it brings rural contacts to the people of Kansas City.

Jackson County voters made the plan possible by approving a bond issue of $6,500,000 to cover the cost of building 166 miles of concrete roads, 52 miles of secondary roads, developing park areas, and otherwise "opening up" the county. But first of all, a complete plan was developed by competent engineers, unbiased politically and instructed only to determine the practical needs of the county. The voters knew exactly what was proposed.

Hundreds of counties throughout the United States are blest with similar opportunities, where picturesque rural sections can be brought within the scope of the early evening and Saturday afternoon drives of a city population. A planned system of county roads and parks, and judicious publicity for the system, will bring these two elements of our national life into closer contact, to the permanent benefit of both.

Wagner Plan Revived

AMENDMENTS sponsored by Senator Robert F. Wagner, of New York, are designed to cut red tape and eliminate hampering restrictions in the granting of loans to state and local governments by the Reconstruction Finance Corporation.

Since last July, when 1½ billion dollars of credit was made available for this purpose, hundreds of cities and towns have been refused loans for needed public improvements because they were not self-liquidating. By February 15, only one-tenth of the fund had been transformed into loans.

Under the proposed amendments, loans may be made on any projects which are needful and in the public interest. These amendments, it is believed, will revive many projects that were previously turned down, and they will bring to life many other useful public improvements.

Adoption of the amendments should create an immediate upturn in construction and employment.

PROGRESS—In a Page

Current activities in research, in matters pertaining to concrete and cement, as being carried on or completed by various organized groups.

Three-Year Tests of Clay Admixtures

TESTS to determine the effect of clay admixtures in concrete, mentioned on this page in the March (1931) issue of CONCRETE, have now extended over a period of three years at the National Bureau of Standards, Washington, D. C. The results of the tests are reported by D. A. Parsons in the Bureau of Standards *Journal of Research*, February, 1933, pages 257-273.

For these tests a basic mixture without clay, and containing 5 bags of cement per cu. yd. of concrete, served as a reference. All concretes were of the same consistency, as determined by a penetration test. Three different cements and three different clays were used in a number of combinations. All specimens were kept in damp storage at 70 deg. F. for 28 days and thereafter some were stored outdoors and the rest were subjected to freezing and thawing. Specimens were tested for compressive strength at the ages of 7 and 28 days, and for strength, absorption and permeability at ages of 3, 6 and 9 months, and at 1, 2 and 3 years.

The substitution of clay for 10 per cent of the volume of the cement caused a small decrease in compressive strength of the concrete at ages greater than 3 months. The permeability was not changed appreciably.

Substituting clay for 7½ per cent of the volume of the fine aggregate increased the compressive strength of the concrete from 1 to 37 per cent. The permeability at the early test ages was decreased, but at later ages it increased both actually and relative to concrete without clay.

The clay admixtures had no apparent effect on the resistance of the concretes to freezing and thawing exposure, since no disintegration occurred among those which were kept damp. All of the specimens, with and without clay, which were subjected both to an occasional drying and to freezing and thawing exposure were disintegrated.

The differences in absorption, permeability, and resistance to freezing and thawing between concretes containing clay and those not containing clay were small.

Enlarging Calcium Chloride Specifications

THE American Society for Testing Materials specifications for Calcium Chloride, D98-30T, which cover material for application to the surface of highways as a dust preventive, are being revised to enlarge the scope of the specifications to cover calcium chloride for a number of other purposes, including its use in curing of concrete and other applications in concrete construction.

Specifications for Ready-Mixed Concrete Completed

COMMITTEE C-9 on Concrete and Concrete Aggregates, at its meeting on March 10, held in conjunction with the spring group meetings of A. S. T. M. committees, approved for submission to letter ballot vote of the entire committee the proposed Specifications for Ready-Mixed Concrete.

The proposed specifications were announced and discussed at a recent meeting of the National Ready Mixed Concrete Association, when R. B. Young, testing engineer, Hydro-Electric Power Commission of Ontario, who is chairman of the subcommittee which is responsible for the specifications, presented a technical paper outlining the specifications in detail. If, as expected, the letter ballot vote of Committee C-9 is favorable, the specifications will be submitted to the society in June with the recommendation that they be approved for publication as tentative.

To Offer Specifications for Cement for Pavements

AT its meeting in New York, held in conjunction with the spring group meetings of A. S. T. M. committees, Committee D-4 on Road and Paving Materials approved several actions affecting the specifications and test methods under its jurisdiction. The committee received the proposed Tentative Specifications for Portland Cement Concrete for Pavements. These were prepared by a subcommittee under the chairmanship of R. W. Crum, director, Highway Research Board. These specifications were approved at the meeting and will be submitted to letter ballot action of the entire committee. If the vote is favorable the specifications will be submitted to the Society at its annual meeting in June, with the recommendation that they be approved as tentative standard.

Concrete Brick Specifications Revised

THE American Society for Testing Materials revised Tentative Specifications for Concrete Building Brick (C55-33T) have been approved for publication as tentative standard on the recommendation of Committee C-3 on Brick. Changes have been made chiefly to bring the specifications in line with existing A. S. T. M. specifications for building brick made from clay or shale and for sand-lime building brick. Strength requirements for Grade B brick have been raised from 2,250 to 2,500 lb. per sq. in. and the minimum requirement has been raised from 1,500 to 2,000 lb. per sq. in.

Copies of the specifications may be obtained in the form of a printed leaflet at 25 cents each, by addressing the secretary of the A. S. T. M. at 1315 Spruce St., Philadelphia. Special prices will be quoted for quantity orders.

A. S. T. M. Specifications for Light-Weight Aggregate

SPECIFICATIONS for light-weight aggregate, prepared by a subcommittee of A. S. T. M. Committee C-9 on Concrete and Concrete Aggregate, were submitted to the full committee at its meeting in New York on March 10. Action was taken toward submitting the proposed specifications to letter ballot vote of the committee membership.

Place Concrete Under Water Through Vibrated Tremie Spout

High-Frequency Vibrators Accelerate Flow of Low-Slump Concrete—Mass of Concrete Not Penetrated by Water

THE use of high-frequency vibrators made it possible to place low-slump concrete under water with a tremie, on a highway bridge contract near Manistee, Mich., in the latter part of 1932.

It is well known that success in placing concrete under water depends mainly upon the ability to cause mixtures of proper consistency to flow into position without external puddling or spading, which would permit the incursion of water. The use of a tremie facilitates such placement; but with this equipment, as with other methods of placing, it is necessary to use concrete of a reasonably dry consistency so as to prevent washing away of the mortar.

Place Concrete of Low Slump

On the Manistee bridge contract the concrete placed under water with the tremie had an average slump of 3 in. The high-frequency vibrators were employed in a way that applied the principle of internal vibration, thus causing the material to spread from internal pressure rather than from external spading or other forms of manipulation.

Two methods of operation with vibrators were tried out on this work, both of which gave highly satisfactory results. The first method was in the nature of a preliminary test, during which concrete was placed in about 4 ft. of water, in a box built for the purpose. An internal vibrating tool, which consists essentially of a long-handled vibrating "spade" and is watertight, was placed alongside the spout of the tremie. As the pile of concrete was built up at the base of the spout the vibrator was alternately turned on and shut off, this action causing the pile to spread. This experiment demonstrated that even a thin layer of concrete could be placed successfully, for there was no evidence of water having penetrated the mass. The action of the vibrator caused no separation of aggregates, and there was no disturbance of the surface.

How Concrete Was Vibrated

The procedure just described was somewhat modified on the actual construction work. One vibrator was attached to the hopper at the top of the tremie spout, but because of the close spacing of the foundation piles it was decided not to use the long-handled vibrating "spade" used in the experimental work described above. Instead, a second vibrator was attached to the top end of a 6-in. cast iron pipe, and this was lowered and placed within the concrete. The action of the vibrator attached to the pipe undoubtedly had some beneficial results; but it was evident that the vibrator attached to the hopper of the tremie was mainly responsible for the greatly improved flow through the spout, and for the fact that concrete with a slump as little as 3 in. could be placed with a tremie. This latter fact, of course, explains why it was possible to use a low water-cement ratio in the concrete on this work.

Acknowledgments

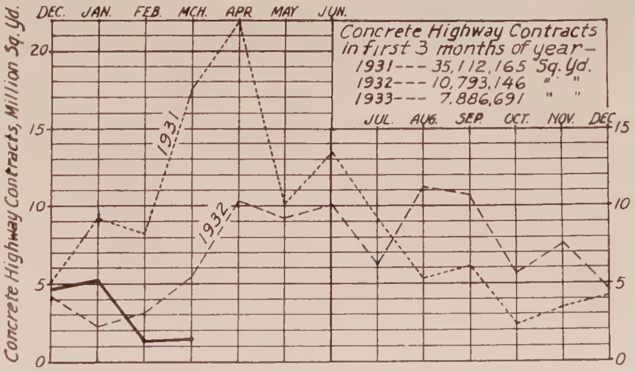
The bridge on which this concrete work was placed was designed by the bridge division of the state highway department of Michigan. The vibrating equipment was supplied by the Electric Tamper and Equipment Co., of Ludington, Mich. This last-named company also conducted the experimental work described. The contractor on the bridge work was the Strom Construction Co., Grand Rapids, Mich.

Possibility of Further Diversion Retards Highway Awards

Highway Construction Programs Held Up Pending Legislative Action

It is evident that highway construction programs are being held in abeyance, largely through lack of definite knowledge as to the action to be taken by state legislatures. The extent to which highway construction funds are to be diverted to other uses still remains an unanswered question in many states.

In addition, there is the further retarding effect of numerous changes in state government administrations, and the resulting changes in the appointive offices in state highway departments.



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A considerable part of the special federal aid fund of $120,000,000 made available in the Federal Relief Act of 1932 remains unexpended. Highway departments may draw on this fund until June 30, the end of the present fiscal year, and it is probable that some states will yet arrange to take advantage of the opportunity offered by the federal government.

Water-Cement Ratio Trial Method of Designing Pavement Concrete

Urged in Preference to Mortar-Voids Method—Fixed Ratio Between Crushing and Flexural Strength Does Not Hold for Some Aggregates

MR. MORRIS has presented a very interesting discussion of the results being obtained in Iowa through the application of the Talbot-Richart mortar-voids theory of designing concrete mixtures. He has cited impressive figures to indicate economic advantages through the use of mixtures designed to produce concrete of a definite required quality in place of the old style arbitrary method of proportioning.

I shall not attempt discussion of the technique of the mortar-voids determination, but confine my remarks to one or two points regarding the utilization of the data to the general problem of designing concrete pavement mixtures.

IN a paper* headed "The Mortar-Voids Method of Designing Concrete Mixtures," printed in the September (1932) *Journal* of the American Concrete Institute, Mark Morris, research assistant, Iowa State Highway Department, describes the practice of the department in applying the Talbot-Richart mortar-voids method to the control of concrete pavement mixtures.

F. H. Jackson, of the U. S. Bureau of Public Roads, in a discussion printed in the January (1933) *Journal*, questions the value of the mortar-voids method in sections of the country where there is a marked difference in the strength of the coarse aggregates commonly used. He prefers the water-cement ratio trial method as the basis for design. Mr. Jackson's discussion is here presented in full.

Prefers Flexural Strength as Basis of Design

In the first place, I question very much the use of crushing strength as the basis of design when the concrete is to be used in pavement construction. It is true that adequate resistance to compression is essential. However, everyday experience teaches us that a concrete pavement is far more apt to fail in tension or flexure than in compression, due to the fact that the tensile or flexural strength of the concrete is much more likely to be exceeded by reason of contraction of the slab or the application of excessive wheel loads, than is the crushing strength. As a matter of fact, failures in compression are confined almost entirely to occasional "blow-ups" or local crushing at joints due to expansion. By and large, this type of failure is comparatively rare. It would seem, therefore, that designing paving mixtures on the basis of crushing strength is justified only on one condition; namely, that, for the types of materials available, the flexural and tensile strength of the concrete varies in proportion to its crushing strength; in other words, that designing for a definite crushing strength will automatically insure a correspondingly definite resistance to flexure. I believe that, within reasonable limits, this condition applies in the state of Iowa. So far as conditions in Iowa are concerned, therefore, I can have no quarrel with the method of design proposed. However, experience has indicated that for many types of aggregates a fixed ratio between crushing and flexural strength does not hold. I should like to illustrate this by reference to the problem of designing a concrete paving mixture for the Mount Vernon memorial highway.

It so happened that, while practically only one type of sand was available for use on this job, there were three distinctly different types of coarse aggregate available. One of these produced a concrete very low in flexure as compared to its crushing strength, while the other two produced concrete having high flexural strength compared to crushing strength.

High-Strength Aggregate Increases Flexural Strength

Repeated tests have shown that, for the same water-cement ratio, concrete containing the high-strength aggregate will have a flexural strength approximately 30 per cent higher than concrete containing the low-strength aggregate and that, to obtain concrete of equivalent flexural strength, a differential of nearly 0.2 in water-cement ratio must be made in favor of the higher-strength materials. Bear in mind that the same fine aggregate is used in both cases, and that therefore the same mortar voids relations would apply in each case. It is obvious, therefore, that a design based on mortar-voids studies alone, while it might have produced concrete of equal crushing strength, would have resulted in widely different flexural and tensile strengths. Bear in mind, also, that both the so-called "Older" corner formula for computing pavement thickness and the Westergaard theory assume a definite flexural strength for the concrete to be used.

In the case cited, it was found that the difference in the strength characteristics of the coarse aggregates warranted a differential of one sack of cement per cubic yard of concrete. On this basis the specifications were set so as to require 7 sacks per cubic yard for the lower-strength material and 6 sacks for the higher-strength materials. The contractor chose the 7-sack proportion, and it is interesting to note that, whereas the structural design called for a modulus of rupture of 600 p.s.i. at 28 days, the average of all tests of concrete beams cast on the job was 615 p.s.i. The average crushing strength, on the other hand, was 4,895 p.s.i. It is quite obvious that if the mortar-voids method of proportioning had been used in this case and the concrete designed for, say, 4,000 lb. crushing strength, the actual modulus of rupture would have fallen far below the 600 lb. required by the design of the pavement. This case is cited simply to show that, where aggregates producing concrete having low flexural strength are encountered, some provision must be made for compensating for this low strength. I know of no better way of doing this than to lower the water-cement ratio until the desired strength is attained.

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*Presented at the 28th Annual Convention, March 1-4, 1932, Washington, D. C. Published, *Journal* Amer. Concrete Inst., Sept., 1932. *Proceedings*, V. 28, p. 9.

†U. S. Bureau of Public Roads.

I should like to say also that the aggregate problem just illustrated is by no means a local one. Aggregates of the type indicated are widely distributed. Differences of this nature are probably less marked in some of the Mississippi Valley states than elsewhere. Where they do occur, I believe that we should recognize them and provide a method of design which will take such factors into consideration.

Advocates Water-Cement Ratio Trial Method

It seems to me that the simplest, most direct and most practical method of determining the proportions required for any given strength is by the water-cement ratio trial method. This was the method of design used in the Mount Vernon Highway work. It is also being used by certain of the state highway departments for designing pavement concrete. The method, expressed in the simplest terms, provides for a determination of the particular water-cement ratio required to produce concrete of the specified strength for each combination of aggregates, both fine and coarse, available for use. The method may, of course, be applied to studies of the crushing strength as well as flexural strength and may also be extended if desired to investigate the influences of particular cements upon strength.

There can be very little question as to the correctness of the fundamental relations between mortar strengths and voids as revealed by the mortar-voids tests. These seem to be well established. However, Mr. Morris questions the use of voids-strength relations based on average results for a group of sands and prefers to use curves derived from studies of each particular sand. This necessitates strength tests on each sand and if this is necessary I am wondering why we can not go just one step further and make strength tests on the concrete instead of assuming that the mortar-voids strength relations tell the entire story and that the coarse aggregate has nothing to do with it.

So long as we persist in building concrete roads as we do at present, that is, simply spreading the concrete on the subgrade and smoothing it off without any compaction to speak of, we must avoid the use of very dry mixtures in order to prevent honeycomb. For this reason it is necessary to use plastic mixtures having fairly high relative water contents. For this type of mix the voids-cement ratio corresponds very closely to the water-cement ratio, so that relations established as the result of studies of one ratio would apply with equal force to the other.

From the standpoint of simplicity and adaptability to everyday construction operations I believe that the use of the water-cement ratio is preferable to voids-cement ratio. For the type of mixtures in which the highway engineer is interested, tests to determine the relation between strength and water-cement ratio performed on concrete specimens are more satisfactory, we believe, than the somewhat complicated series of laboratory tests on mortar specimens which it is necessary to make in order to establish mortar-voids strength relations for any given sand.

Housing Conference on May 9 and 10

The date for the national conference on home building, mentioned in the editorial "No Room for Factory-Built Homes" in the April issue of CONCRETE, has been set for May 9 and 10, while the place selected for the sessions is the Congress Hotel, in Chicago. The meeting will be held under the chairmanship of J. Soule Warterfield, vice-president of the Starrett Building Company.

The new and optimistic national outlook leads the thirty leaders in the construction and allied trades who are sponsoring this conference to feel that the time is ripe to consider home building programs in all parts of the country. The conference is to be held to give this long dormant business the proper kind of an awakening.

Admission to the conference will be by card, which can be obtained from the secretary, Henry A. Guthrie, Room 1041, 310 South Michigan Avenue, Chicago, Illinois.

FROM THE PATENT OFFICE

METHOD OF MAKING BUILDING MATERIAL — No. 1,893,607. Anthony M. Zottali, of Quincy, Mass.

This invention relates to a building material in sheet form used mainly as a substitute for travertine or Italian marble for the construction of walls and for other portions of buildings.

The invention comprises a building product in sheet form provided with a plastic surface having a characteristic appearance imparted to it by the formation of cavities of irregular shape and of varying size, preferably arranged to appear like travertine or Italian marble, in veins extending across the surface of the material. The cavities are formed in the plastic material by gas generated in the upper portions of the plastic material adjacent to the surface thereof.

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FLOOR CONSTRUCTION—No. 1,893,742. Paul G. Heidman, of Detroit, Mich.

This invention relates to a floor construction whereby a durable upper layer may be mounted on a non-yielding base and a resilient floor provided. The invention is particularly adaptable for use in mounting on a base or slab formed from concrete or other similar material, an upper wearing surface formed from concrete or the like, and so mounted on the base as to be yieldable.

On the usual concrete base is spread a coating of hot asphalt while the asphalt is in its plastic condition. A layer of fibrous material is then applied to the asphalt and on top of this layer is spread a waterproof coating of asphalt or the like. On top of this is poured a top cover of plastic or concrete material which forms the wearing surface.

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CONCRETE BRIDGE—No. 1,893,491. Karl P. Billner, of New York, N. Y. Assigned to the Aerocrete Corporation.

This invention relates to concrete bridges and the main object of the invention is to reduce the cost of construction without impairing its strength. The inventor claims that by means of this invention he is able to make a concrete bridge of not more than half the weight of that now required for equal strength, while at the same time it can be made cheaper, and will resist practically indefinitely the deteriorating effects of the weather.

HOW TO DO IT

◆ **Questions and Answers** ◆
Consultation and Comment

A department devoted to the solution of problems encountered in concrete work. Readers are welcome to add to or improve upon the suggestions printed and to submit their views for possible publication.

Mixing Bitumen With Cement to Reduce Shrinkage

I have for some years had the feeling that the use of monolithic concrete in direct architectural treatment could be greatly extended if some way could be found to reduce the shrinkage of the cement paste in the concrete.

During the past year I have seen several articles and news items in CONCRETE *in which reference was made to a special cement consisting of a bituminous material mixed with ordinary portland cement. One of the properties claimed for this cement is that expansion and contraction under given temperature changes are greatly reduced.*

This may be the solution to the problem.—T. A. C., San Francisco, Calif.

Your suggestion is certainly worth careful study and investigation. The special cement to which you refer is (presumably) the product made under the Sommer patents by the Medusa Portland Cement Co. This cement is said to be a mixture of ordinary portland cement and bitumen. One of the properties claimed for it is low volume change with changes in temperature.

A recent British patent (No. 378,107), granted to H. Plauson and M. Imer, covers a bitumen-cement mortar which is produced by grinding a bituminous material such as tar or pitch, preferably in the liquid state, with lime, then mixing this finely ground product with portland cement. If desired, more lime may be added. It is claimed that mortar in which this bitumen-lime-cement mixture is used undergoes relatively little change in volume with changes in temperature. Copies of British patents may be obtained by addressing the Patent Office, Industrial Property Department, Board of Trade, 25 Southampton St., London, England.

Census of Contractors

Several years ago the government made a survey of contractors in the United States. Can you tell me whether the results of that survey have been published, and from what department a copy of the report can be obtained?—M. C. E., Seattle, Wash.

In 1930 and 1931 the U. S. Census Bureau made a survey of contractors who had a total business of $25,000 or more in the year 1929. The results of the survey will be found in a book entitled "Fifteenth Census of the United States—Construction Industry, Summary for the United States," copies of which may be obtained at 20 cents each from the Superintendent of Documents, Government Printing Office, Washington, D. C. The number of individual contractors or firms included in the report totals 30,597.

Binders Other Than Cement, Clay and Lime

For many years I have been interested in the production of building materials from the various cementitious binders such as cement, clay and lime.

Can you tell me what other cementing materials are commercially available for this purpose?—R. A. K., Phoenixville, Penna.

You are probably familiar with the fact that materials such as finely pulverized shale and blast-furnace slag, flue dust from stacks of power houses in which pulverized coal is used as fuel, and some other waste products, have varying degrees of cementing value. It is usually necessary, however, to grind other materials with them in order to obtain satisfactory cementing properties.

In a word, these products are used primarily as a portion of the raw materials in the manufacture of finished products such as portland cement.

Concrete Septic Tanks

We are under the impression that one of the federal government departments has issued a booklet on the subject of concrete septic tanks. If so, can you tell us under what title and by which department it was printed?—H. C. P. Seattle, Wash.

The U. S. Department of Agriculture has published a bulletin on concrete septic tanks, under the title of "The Sanitary Disposal of Sewage Through a Septic Tank." Copies may be obtained at 5 cents each from the Superintendent of Documents, Government Printing Office, Washington, D. C.

The Portland Cement Association also has published a bulletin on this subject, under the title of "Safe Sewage Disposal."

Concrete Tennis Courts

In our capacity of concrete contractors we have been requested by a private club in this city to obtain data on the construction of concrete tennis courts.

Doubtless you have published something on this subject, but we are new subscribers to "Concrete," and therefore we will appreciate such information as you can give us.—J. C. S., Somerville, N. J.

The July (1930) issue of CONCRETE, pages 51-53, contains an illustrated article, showing plans and cross-sections of concrete tennis courts and a complete set of specifications.

Other recent articles on the construction of concrete tennis courts appear in the issues of June, 1931, pages 31-32; September, 1931, pages 33-34; and May, 1932, pages 23-24.

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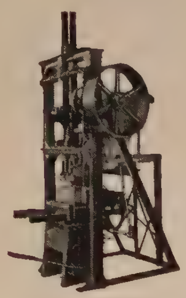
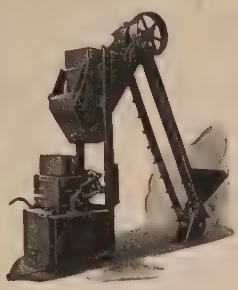

Power Tamper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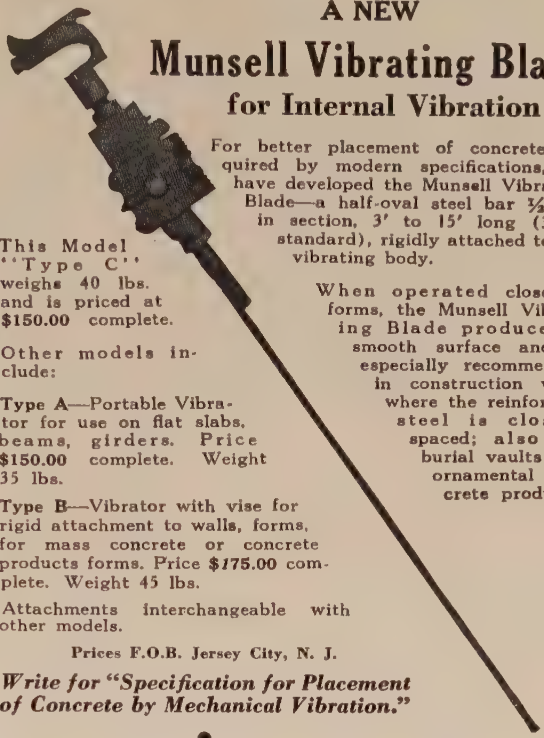

For better placement of concrete required by modern specifications, we have developed the Munsell Vibrating Blade—a half-oval steel bar ½"x2" in section, 3' to 15' long (3' is standard), rigidly attached to the vibrating body.

When operated close to forms, the Munsell Vibrating Blade produces a smooth surface and is especially recommended in construction work where the reinforcing steel is closely spaced; also for burial vaults and ornamental concrete products.

This Model "Type C" weighs 40 lbs. and is priced at **$150.00** complete.

Other models include:

Type A—Portable Vibrator for use on flat slabs, beams, girders. Price **$150.00** complete. Weight 35 lbs.

Type B—Vibrator with vise for rigid attachment to walls, forms, for mass concrete or concrete products forms. Price **$175.00** complete. Weight 45 lbs.

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"Over Half a Century Making Good Colors"

New Books and Pamphlets

Cement-Bound Macadam Roads

Cement-Bound Macadam is the title of a new 16-page publication just issued by the Portland Cement Association, 33 W. Grand Ave., Chicago.

This well illustrated booklet presents a history of cement-bound macadam in both Europe and America, describing one such pavement in Scotland that is more than 60 years old and still in service.

It also describes the revival of interest in this low-cost, rigid surface, and the application of modern methods and equipment to the construction of five such pavements during 1932. Recommended design practice and specifications for this type of pavement are also included.

The booklet is available for free distribution.

Measuring Thermal Expansion

The Interference Method of Measuring Thermal Expansion is the title of an 18-page pamphlet, by George E. Merritt, published as Research Paper No. 515 by the National Bureau of Standards, Washington, D. C.

The pamphlet is intended as an illustrated manual for the use of investigators in measuring thermal expansion by the interferometric method. The text includes descriptions of the apparatus, method of making specimens, forms for taking data, and computation of data. Tables and special calculations are given in an appendix.

Copies may be obtained at 5 cents each from the Superintendent of Documents, Government Printing Office, Washington, D. C.

Highway Improvement

Economics of Highway Improvement. Published in March, 1933, by the Portland Cement Association, 33 W. Grand Ave., Chicago. Paper cover, 20 pages, 8 by 11 in. Many tables, formulas and computations. Copies available on request.

This booklet is a technical treatise of the subject, prepared in such a way that highway engineers can apply it to their own traffic, construction and maintenance problems and quickly determine where and how to build roads. It summarizes the work of the Highway Research Board in developing the tests and details needed to place road building on a sound business basis. The essential findings of the Board's committee on economics of highway improvement are here assembled for the first time under one cover, and applied to a practical solution of road building problems.

Specifications for Roofing Tile

Standard Specification for Concrete Plain Roofing Tiles is the title of a new specification issued in the form of a 13-page pamphlet by the British Standards Institution, 28 Victoria St., S. W. 1, London, England. Price 2s.

The specification deals only with unreinforced roofing tile, and contains sections covering materials, proportions, colors, sizes, flutes, cambers, nail holes, and tests.

ORGANIZATIONS

American Association of State Highway Officials; W. C. Markham, Executive Secretary, 1222-24 National Press Building, Washington, D. C.

American Concrete Institute; Harvey Whipple, Secretary, 641 New Center Building, Detroit, Mich.

American Concrete Pipe Association; M. W. Loving, Secretary, 33 West Grand Ave., Chicago. Twenty-sixth annual convention, June 26-27. Edgewater Beach Hotel, Chicago, Ill.

American Road Builders' Association; Chas. Upham, Engineer-Director, National Press Building, Washington, D. C.

American Society of Civil Engineers; Geo. T. Seabury, Secretary, 33 West Thirty-ninth St., New York City. Annual convention, June 27-30, Chicago, Ill.

American Society for Testing Materials; C. L. Warwick, Secretary-Treasurer, 1315 Spruce St., Philadelphia, Pa. Annual meeting, June 26-30, Stevens Hotel, Chicago, Ill.

Associated General Contractors of America; E. J. Harding, Managing Director, 222 Munsey Bldg., Washington, D. C.

Building Officials Conference of America; Col. John W. Oehmann, Secretary, 1253 Lawrence St., N. E., Washington, D. C.

Cast Stone Institute; L. A. Falco, Secretary, Chapel St. and Blatchley Ave., New Haven, Conn.

Cement Institute; H. C. Lundborg, General Manager, 11 East 44th St., New York City.

Concrete Masonry Association; Jack Franklin, Secretary, 7071 Plankinton Bldg., Milwaukee, Wis.

Concrete Reinforcing Steel Institute; R. W. Johnson, Secretary, 333 North Michigan Ave., Chicago, Ill.

Engineering Institute of Canada; 2050 Mansfield St., Montreal, Quebec.

Highway Research Board; Roy W. Crum, Director, 2101 Constitution Ave., Washington, D. C.

Joint Committee on Standard Specifications for Concrete and Reinforced Concrete; F. R. McMillan, Secretary, 33 West Grand Ave., Chicago.

National Board of Fire Underwriters; W. E. Mallalieu, General Manager, 85 John St., New York City.

National Concrete Burial Vault Association; J. H. Stuart, Secretary-Treasurer, Bremen, Ohio. Annual meeting, May 18-19, Statler Hotel, Cleveland, Ohio.

National Crushed Stone Association; J. R. Boyd, Secretary, 1735 14th Street, N. W., Washington, D. C.

National Engineering Inspection Association; B. H. Witherspoon, Secretary, P. O. Box 1115, Pittsburgh, Pa.

National Fire Protection Association; Franklin H. Wentworth, Secretary, 40 Central St., Boston, Mass.

National Lime Association; Norman G. Hough, Secretary and Manager, 927 Fifteenth St., N. W., Washington, D. C.

National Ready-Mixed Concrete Association; V. P. Ahearn, Secretary, 545 Munsey Bldg., Washington, D. C.

National Sand and Gravel Association; V. P. Ahearn, Executive Secretary, 545 Munsey Bldg., Washington, D. C.

National Slag Association; H. J. Love, Secretary-Treasurer, 1449 Leader Bldg., Cleveland, Ohio.

National Terrazzo and Mosaic Association; U. F. Durner, Secretary, 815 West St. Paul Ave., Milwaukee, Wis. Annual meeting, June 19-22, Palmer House, Chicago, Ill.

Northwest Concrete Products Association; W. P. Hews, Secretary-Treasurer, Yakima, Wash.

Portland Cement Association; Edward J. Mehren, President; William M. Kinney, General Manager, 33 West Grand Ave., Chicago.

Rail Steel Bar Association; H. P. Bigler, Engineering Secretary; Builders' Bldg., 228 N. La Salle St., Chicago, Ill.

Wire Reinforcement Institute; R. D. Bradbury, Director, National Press Bldg., Washington, D. C.

Wisconsin Concrete Products Association; Jack Franklin, Secretary-Treasurer, 425 East Water St., Milwaukee, Wis.

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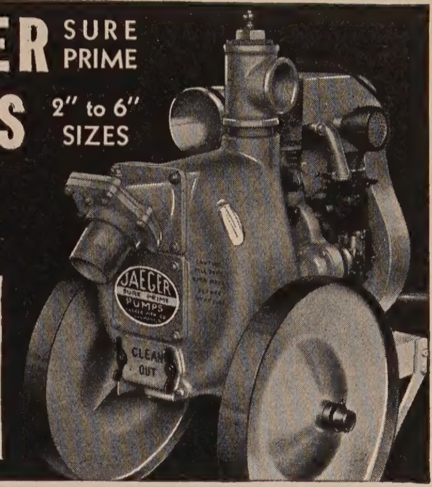

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Plain Pallet Strippers pay for themselves in first cost and in operating cost as they make an endless variety of concrete units upon a single set of inexpensive plain Pallets. Now available at any price and capacity desired and with improved features.

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This Economy Double-Headed Nail will save you money on formwork

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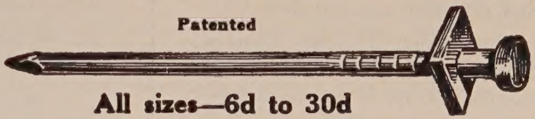

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Chicago Rep.: PROCTOR & JOHNSON
327 S. La Salle St. Chicago, Ill.

New Pump Handles Bulk Cement With Low Power Consumption

Construction Projects, Concrete Products and Central Mixing Plants, Find Use for Portable Unit

A NEW pump for transporting bulk cement to storage bins or vice versa, or from one storage bin to another, is offered to the construction industry by F. L. Smidth & Co., of New York City. The pump is, of course, adapted to the handling of bulk cement in cement manufacturing plants; but in the construction industry it is especially applicable to the handling of cement from storage to charging bins of ready-mixed concrete plants, concrete products plants, concrete mixing plants on large construction contracts, and the like.

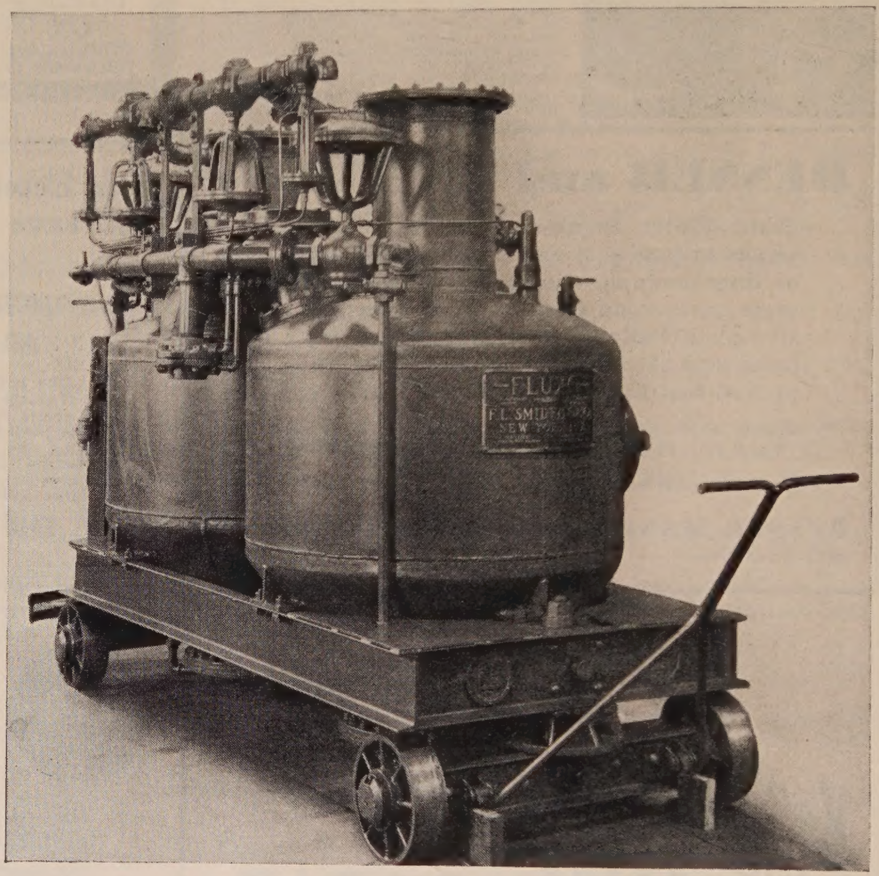
This new equipment is known as the Fluxo pump, and it is made in two general types, one of which is a suction-feed type and the other a gravity-feed.

The Fluxo pump is unique because of its elimination of a mechanical feeder. Features claimed for it are dependability, low maintenance costs, due to the elimination of rotating parts subject to wear. It permits variation in the flow of transported material from zero to maximum without adjustments or attendance. It will handle from 300 to 400 bbl. of cement per hour when used with a 6-in. transport line.

The suction-feed pump shown in the illustration consists of two tanks mounted on a carriage, permitting the unit to be wheeled either on tracks or directly on a floor to the location required.

The principle of operation is simple, consisting of alternately subjecting the tanks to vacuum and pressure. While the cement to be pumped is drawn into one pump tank by suction, it is being expelled from the other by compressed air. Then the cycle of operation is reversed, the tank previously under vacuum being placed under pressure and the pressure tank being placed under vacuum. The repetition of these cycles is automatic, once the pump has been started, and the flow of material is steady and continuous.

Wherever conditions are such that the cement can flow to the pump by gravity, the gravity-feed type of pump may be used. Aside from the gravity feed, this type operates on the same principles as the suction-feed unit, the material being discharged by means of compressed air.



EQUIPMENT AND MATERIALS

New Self-Priming Pump Rounds Out Rex Speed Primer Line

The Chain Belt Co., Milwaukee, announces a new 3-in. self-priming centrifugal pump which rounds out its line of Rex Speed primers. This new self-priming Rex unit is of the recirculating type, and is automatic in action after the recirculating system is once filled.

This particular size has been developed to provide a pump very close to the same light-weight portability of the 2-in. class, with a greatly increased capacity. The new Rex meets the A.G.C. rating for 3-in. pumps with capacity to spare.

It is claimed by the manufacturer that this new type recirculating system will pick up the prime in record time on any suction lift up to 25 ft. and it continues to pump with an air leak in the suction line that stops an ordinary centrifugal pump but only reduces the capacity of the Rex.

The new 3-in. Speed primer is completely described in Bulletin No. 230, which illustrates the line of Rex 2, 2½, 3, 4 and 6-in. Speed primers.

Oil and High Temperature Resistant Cable Developed by General Electric Co.

A new cable insulated with Glyptal-treated cloth and capable of resisting oil and withstanding high temperatures has been developed by the General Electric Co., and is now available in all types. In addition to its ability to resist oil and heat, this new cable is said to be characterized by unusual flexibility and toughness that enables it to stand severe mechanical strain.

BOOKS On Concrete

The books listed below have been carefully selected by our editorial staff as useful to those engaged in making concrete in all its various forms. Prices are cash in advance and include postage.

DESIGN AND CONSTRUCTION OF FORM WORK FOR CONCRETE STRUCTURES. By A. E. Wynn. 312 pages, 219 ills., 12 folded inserts and 11 design tables. Cloth bound, stamped title in gold. **Price $6.00**

"Wynn's Book" is a phrase commonly known to engineers, designers, and foremen, and is heard wherever concrete construction is under way. This book covers every phase of forms for concrete construction, and is fully and completely supplemented with many significant illustrations, tables and drawings and printed on a superior grade of enameled paper.

CONCRETE CONSTRUCTION MADE EASY. By Leslie Turner and Albert Lakeman. 113 pages, 65 illustrations, 16 tables. Cloth bound. **Price $2.00**

A practical book that solves problems in the design and erection of any type of concrete structure. Full designs with tables and all necessary information for building of foundations, walls, columns, floors, roofs, staircases, beams, water tanks, retaining walls, lintels, formwork, saw-tooth roofs, etc. A mine of information to the novice and a fruitful source of advice for the experienced. Written clearly and plainly.

MANUFACTURE AND USES OF CONCRETE PRODUCTS AND CAST STONE. By H. L. Childe. 354 pages. 265 illustrations. Color plates. Photographs. Completely rewritten and enlarged. **Price $3.00**

Deals with problems of how to: use dry mixes for architectural concrete; minimize crazing and efflorescence; design all kinds of molds; select materials; grade and proportion aggregates, regulate mixing, and govern curing; use color in concrete; manufacture columns, cornice posts, curb, blocks and slabs, brick, roofing tile, steps, sills, lintels and edgings, balustrades, sundials, bird-baths, lettered panels, ornamental work, etc. This new 1930 edition simplifies every phase of manufacture of concrete products and cast stone of every description for every purpose.

BASIC PRINCIPLES OF CONCRETE MAKING. By Franklin R. McMillan, Director of Research, Portland Cement Association.

The author has culled the essentials out of a mass of scientific data on this subject and presents them with force and directness in this book. He shows the effects of quality of material, of proportioning, mixing, working and curing on the finished concrete.

The importance of variable mixes; tests for permeability; how to obtain strength, durability and watertightness; effective ratios; importance of proper construction methods—these and many other vital topics are discussed fully and authoritatively.

The book represents not only extensive accumulated knowledge, but also wide practical experience in the field and laboratory. It is an enlargement and revision of a series of notable articles on concrete mixing by Mr. McMillan published in 1929.

Ninety-nine pages, 6x9½, 32 illustrations and tables. Postpaid. **Price $2.00**

CONCRETE MONUMENTS, MAUSOLEUMS AND BURIAL VAULTS. By A. A. Houghton. 65 pages, illustrated. Paper bound. **Price $.75**

The molding of concrete monuments to imitate the most expensive cut stone is explained in this treatise, with working drawings of easily built molds. Cutting inscriptions and designs is also fully treated.

***MOLDS FOR CAST STONE AND CONCRETE.** By F. Burren and G. R. Gregory. Heavy board cover, 79 pages, 11 by 7¼ in.; 44 full page illustrations. **Price $1.25**

Detailed working drawings for the practical mold maker, covering a wide range of concrete and cast stone products. Drawings supply the necessary information, and brief descriptions are given in each case.

A lot of good information, not only for cast stone manufacturers, but for makers of special products made of ordinary concrete, such as fence posts, chimney caps and pots, well linings, laundry tubs, etc.

***GENERAL ENGINEERING HANDBOOK.** By Charles Edward O'Rourke and 29 associates. Flexible cover; 921 pages, 5 by 8 in., numerous tables, diagrams and illustrations. **Price $4.00**

This book assembles a great amount of fundamental engineering data in usable form. 31 separate sections deal with as many specific branches of engineering.

Of particular interest to engineers who specialize in the use of concrete as a structural material are sections devoted to "Highway," by Thomas R. Agg; "Reinforced Concrete Structures," and "Stresses in Framed Structures," by Charles Edward O'Rourke; "Engineering Materials," by Herbert H. Scofield; "Foundations," by Roland P. Davis; and "Mechanics," by Alfred P. Poorman.

REINFORCED CONCRETE CONSTRUCTION. By George A. Hool, Professor of Structural Engineering, University of Wisconsin. University of Wisconsin Extension Series.

Vol. I—Fundamental Principles. Third Edition. 380 pages, 6x9, 139 illustrations, 18 tables, 28 diagrams **$3.50**

Vol. II—Retaining Walls and Buildings. Second Edition. 700 pages, 6x9, illustrated **$6.00**

Vol. III—Bridges and Culverts. 688 pages, 6x9, over 600 illustrations, 41 plates **$6.00**

***CONCRETE ENGINEERS MANUAL.** By Samuel Baker and A. DeGroot. Cloth, 401 pages, 5 by 7½ in., numerous drawings, charts and tables. **Price $3.00**

This volume is intended as a textbook for students of concrete engineering, and as a reference book for designers, foremen, inspectors, and others involved in the design of concrete structures and in the making and placing of concrete.

The book contains a complete description of the modern methods of proportioning concrete mixtures, mixing and placing concrete and steel, and providing waterproofing. Mathematical tables and the fundamental principles of mathematics and mechanics of materials, as applied to reinforced concrete designs, are included.

Among other subjects treated in individual chapters are form work, foundations, design of retaining walls, and estimating concrete work.

CEMENT CHEMISTRY IN THEORY AND PRACTICE. By Prof. Dr. Hans Kuhl, Director of the Institute for Cement Research, Berlin. Translated into English by J. W. Christelow, B.Sc. 64 pages, 6 by 9, cloth cover. Illustrated with a number of halftones and diagrams. **Price $2.50**

An authoritative book on the chemistry of cement, a translation of a series of lectures delivered by Dr. Kuhl in Moscow, at the special request of the Soviet government. The author presents the most up-to-date knowledge of the subject in simple language. The translator is one who knows his subject very thoroughly. The result is a concise record of modern research on the manufacture and setting of cement.

CONTENTS

1. The development of Cement Research.
2. The Theory of Cement Burning.
3. The Constitution of Portland Cement Clinker.
4. The Problem of Hardening and Its Significance in Cement Research.
5. The Chemistry of High-Strength Cements.
6. The Technical Aspect of High-Strength Cements.

PRE-CAST CONCRETE FACTORY OPERATION. By H. L. Childe, Editor, "Concrete Building and Concrete Products" (England). 190 pages, 5½x9, illustrations and layouts. **Price $2.00**

Complete descriptions of the plant layouts, equipment, methods, and processes of 20 English manufacturers, large and small. Includes the whole range of pre-cast units from the largest cast stone and roofing tile and plain block plants to the small producers of miscellaneous products.

SPECIAL COMBINATION OFFER To Regular Subscribers:

$1.50 (or $2.00 for Cement Mill Edition) added to the price of any of the above listed books will extend your present subscription one year from its present expiration date. Foreign and Canadian subscribers please write for details.

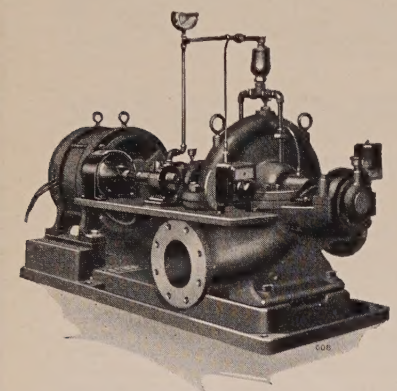
*Newly listed.

Book Department of CONCRETE, 400 West Madison Street, Chicago, Ill.

Self Priming System for Centrifugal Pumps

A system for automatically priming centrifugal pumps which is said to be efficient and which at the same time assure the safety of the pump, as it cannot be started until fully primed and will be automatically stopped should it lose its prime at any time, has been developed by the Pennsylvania Pump & Compressor Co., of Easton, Pa., who are offering it for use on any of their pumps.

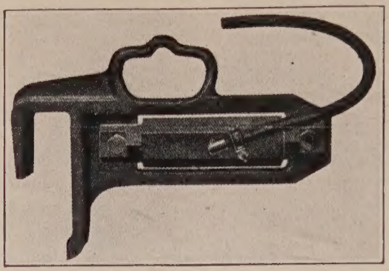
A small motor driven rotary vacuum pump unit, mounted on the centrifugal pump and arranged to evacuate the air in the pump and its suction line, is started either by push button or remote control, as by change in the water level or head, and when the pump is fully primed, the motor is started.



Building up of normal pressure in the discharge pipe stops the vacuum pump, but should the pump lose its prime at any time it is automatically stopped, the vacuum pump started and the cycle of priming repeated.

Mold Vibrator Frequency Is Increased

Increases in frequency and amplitude, resulting in greater density and better surface finishes, have been made on the Branford hand vibrators. These units, made in four sizes by the Malleable Iron Fittings Co., Branford, Conn., are designed for use on concrete products molds, including those for cast stone.



The 1¼-in. piston size now has a 9600-blow frequency; the 1½-in., 8300; 1¾-in., 7700; and the 2-in., 7300. Increases in amplitude average 10 per cent.

These increases in frequency and amplitude have also been made in the table vibrators, spades, on the double attaching head units, and the pipe and pneumatic vibrators.

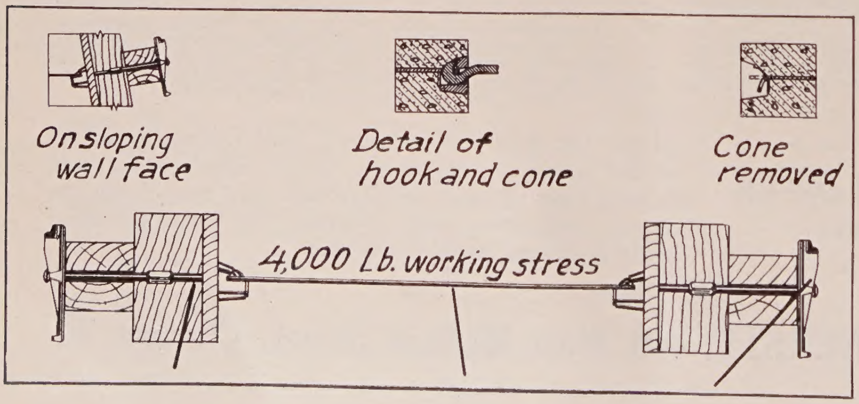
Arro-Tie Is New Form Tie and Spreader

The Arro-Tie Company, Kansas City, Missouri, has introduced a new concrete form unit, sturdy in construction, that acts as a combined tie and spacer. The device is said to be readily installed and easily removed.

The connecting wall tie and spacer is a flat steel I-bar rated at a working stress of 4,000 lb. The engaging form unit consists of a molybdenum steel hooked rod, a non-corrosive alloy cone and a hexagonal coupling, permanently assembled. Waler rods are furnished for all wall systems. The unit is held in position by a drop-forged wedge.

When the forms are released, a light hammer blow on the rod brings dynamic lever action to bear on the cone, forcing it free of the concrete.

The new form unit is in use on a number of construction projects, including several R. F. C. jobs.



Increase Stearic Acid Content of Waterproofing

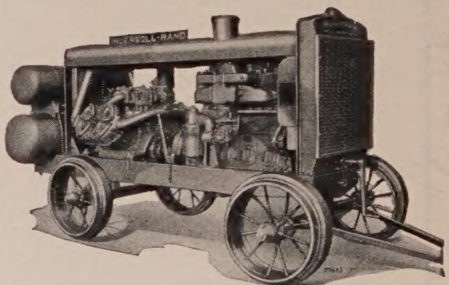
An improved method of processing stearic acid waterproofing paste is announced by Master Builders' research laboratories who have perfected a new product called "Stearox 30." It contains two and one-half times the amount of stearate that has been supplied by conventional waterproofing pastes for the past several years, according to the Master Builders Co., Cleveland, Ohio.

A builder with 10,000 yards of concrete to waterproof has had to use from 9,000 to 12,000 lb. of the waterproofing pastes that have been standard heretofore to get optimum results. By using only 3,600 lb. of the new Stearox 30 or 3.6 lb. per cu. yd. (.6 lb. per sack of cement) he introduces the same amount of stearic acid and obtains the same efficiency, it is stated.

Stationary Compressor Features Adapted to Portable Unit

A portable air compressor recently developed by the Ingersoll-Rand Co., New York City, adapts the recognized advantages of two-stage stationary compressors and makes them usable in portable units.

Tests show that, size for size, the new compressor will deliver 23 per cent more compressed air than previous models, the Ingersoll-Rand Co. states.



The compressor in the new machine is a two-stage, air cooled unit. It has two low-pressure cylinders, arranged in a V, and between them, in vertical position, a high-pressure cylinder.

Wet-Rub Surfacers Do Away with Hand Brushing

Water feed concrete surfacers for wet-rubbing of all kinds of concrete construction are a recent development of the Concrete Surfacing Machinery Co., Cincinnati, Ohio.

These surfacers are now said to displace all hand rubbing, where specifications call for a wet-rub, and to do away with the practice of wetting the surface with a brush.